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Technical Report

AD 640 123

MECHANIZATION STUDY OF THE TECHNICAL LIBRARY, U.S. ARMY EDGEWOOD ARSENAL, EDGEWOOD, MARYLAND

Submitted to

Defense Supply Agency
Defense Documentation Center
Cameron Station, Virginia

by

Booz, Allen Applied Research Inc.
4733 Bethesda Avenue
Bethesda, Maryland 20014

Under Contract No. DSA-7-15489

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September 1966

BOOZ·ALLEN APPLIED RESEARCH INC.

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ABSTRACT

The Edgewood Arsenal Technical Library uses a retrieval system designed and developed for the Library by a contractor. The contractor indexes and processes documents on punched cards, and tapes generated on the Contractor's IBM 1401 are converted to Honeywell 200/400 tapes for use on EA's Honeywell computer by National Institutes of Health and Army Map Service. Search outputs enable the user to obtain desired items from the Library by use of the pertinent call numbers. The addition of an alphabetic printout capability of the existing system is now in the operational testing stage. The hopes of the designers of the system to provide half-day response to user questions have thus far been frustrated by several factors, including the high cost of operating the system and its low speed.

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I. SUMMARY

The Edgewood Arsenal (EA) Technical Library has mechanized its information retrieval system. The present retrieval system was developed by the Technical Information Division of EA based on a feasibility study by Documentation, Inc., and further work by the John I. Thompson and Company (JITCO). The actual computer programs were developed by Data Systems Office of EA. To date, the Library has indexed and processed on punched cards, 33,700 documents. (10,200 of these documents and all of the card preparation were done under contract by JITCO.) Tapes generated on the IBM 1401 at JITCO have been converted to Honeywell 200/400 tapes by National Institutes of Health (NIH) and Army Map Service (AMS), and the Honeywell computer at EA is now able to search these tapes as required. Under the JITCO contract, a thesaurus was generated and printed on their 1401. Also, under the second contract, three pilot searches of 10 questions each were run against the file. Announcement of the retrieval system to the technical staff at EA has been deferred pending further system testing, and de-bugging.

The Information Retrieval Office at EA monitors contracts on the retrieval system. (For organization charts of EA, see Appendix A.)

Input to the system is through the Technical Library collection, and the alternate contract officer is a member of the Library staff. The Information Retrieval Office has a staff of two; the Technical Library has a staff of 25, 8-1/2 of whom are involved in the retrieval system in connection with collection, acquiring, or selecting, as well as indexing.

The Data Systems Office has contributed one systems analyst and one programmer working approximately 50 percent and 20 percent of the time, respectively, over a twenty-one month period.

A backup card catalog file is being maintained for manual searching. It is not expected that this will be discontinued in the near future.

The book and bound periodicals collection number 60,000 items, with an increase of approximately 350 a month. One thousand periodical titles are received under current subscriptions. The document collection, including classified and unclassified items, numbers 235,000 titles (370,000 copies), with an annual increase of approximately 12,000 to 15,000 titles (35,000 copies). There is a collection of 10,000 industrial catalogs, and microfiche, microfilm, patents, and other miscellaneous items number 50,000.

The Technical Library serves the EA complex of 3,000 people, approximately 1,250 of whom are considered active users. Of these,

some 95 percent are scientists and engineers. Circulation at EA totals over 50,000 items. In addition, EA's Technical Library has an active interlibrary loan program with other government agencies and contractors, with a total of 2,239 items, mostly documents, loaned in fiscal year 1965. The majority of items borrowed by the EA Library (over 2,500) are books and periodicals.

Most requests from EA personnel are made in person, with many users obtaining their own references from the card file and material from the shelves. Searches are performed upon request; translations are usually contracted out, although Russian and German translating capabilities are available on the Library staff. Accessions lists prepared in part by the IBM Selectric writer receive wide distribution throughout the Laboratories.

II. MECHANIZATION

1. CHRONOLOGY

In 1960, a contract was let to Documentation, Inc. for a feasibility study of coordinate indexing and machine retrieval of 2,000 Chemical Warfare Laboratories (CWL)--now EA--documents. In December the final report of this contract and a handbook of procedures were furnished to CWL.

In August 1961, an evaluation report was made recommending coordinate indexing. Punched cards were to be used initially.

Late in 1962, an 18-month contract was let to JITCO. In March 1963, "Recommendations for CRDL Descriptor Grouping" was submitted to EA by JITCO. In December 1963, the first contract with JITCO expired. A thesaurus and punched cards on 25,000 documents were furnished.

In April 1964, 450,000 were converted to magnetic tape by the Data Systems Office. Quality control programs were written, and computer runs were made. Design of search and retrieval programs was begun.

In August 1964, a second contract (13 months) was let with JITCO. This was to cover indexing and processing of an additional 8,700 documents, and updating and modification of the thesaurus.

In September 1965, the second contract with JITCO expired. (Additional work has been delayed due to major reorganization of EA.) Later in 1965, tapes were converted from IBM 1401 one-half-inch tape to Honeywell 200/400 three-fourths-inch tape by AMS. Searches are being run against these tapes on an experimental basis.

2. THESAURUS DEVELOPMENT

A word list of 12,500 terms, which consisted of index terms used at Fort Detrick, Dugway Proving Ground, and Atomic Energy Commission as well as EA, was given to JITCO at the beginning of the first contract. This word list was reduced to about 9,500, and these words became the basis for the thesaurus as developed over the period covered by the two contracts.

Additions to the thesaurus were generated from the indexing. During the first contract, an attempt was made at maintaining a high degree of compatibility with DDC. A dictionary of some 40,000 terms produced by the 1401--including identifiers, chemical compound names, equipment nomenclature, and the like--resulted. Because JITCO had concurrent contracts for indexing with both EA and Dugway Proving

Ground, the two Army installations agreed to accept a single thesaurus. Therefore, the thesaurus is a combination of terms used at Dugway, Fort Detrick and Atomic Energy Commission as well as EA.

The thesaurus is in an alphabetical and hierarchical (field-group structure) arrangement. (For sample of field-group structure, see Figure 1.) There were problems in the hierarchy due to terms like "inorganic acids." In the printout of the thesaurus, the various levels of hierarchy for terms are indicated by indentations. Some terms included in the thesaurus are not descriptors in themselves but are added to complete the hierarchy.

Links were used, but experience has indicated that they should be used sparingly and judiciously. In this system, links are added to descriptors only when a false coordination is likely. During a search, descriptors without links may be coordinated with linked descriptors; descriptors with the same link may be coordinated with each other; but two descriptors with differing links may not be coordinated. When the file is reinverted, the link is applied to the accession.

Problems in the first thesaurus developed; a computer processed frequency count was conducted by EA and turned over to JITCO. Infrequently used terms were reviewed for substitution or deletion. However, chemical compound nomenclature and equipment designations

EA FIELD	EA GROUP	ASTIA Groups Included	
		FIRST EDITION	SECOND EDITION
61 Bilogical and Medical Sciences (Continued)	540 Health Physics	116 Health Physics 241 Sanitary Engineering	074 Health Physics 144 Sanitary Engineering
	541 Hormones	118 Hormones	076 Hormones
	569 Pest Control	132 Insects 204 Pest Control and Inhibiting Agents	118 Pest Control
	551 Medicine and Dentistry	069 Dentistry 124 Immunology 149 Medical Equipment 150 Medical Procedures 151 Medicine 259 Surgery and Surgical Equipment 266 Therapy	095 Medicine
	568 Pathology	070 Diseases 126 Infections and Infectious Diseases 201 Pathology 283 Viruses	116 Pathology 165 Viruses

FIGURE 1
Sample of Field-Group Structure

were considered desirable and allowed to remain even though used only once. Very frequently used terms were also reviewed for possible break-out into more specific terms, but certain housekeeping terms such as "unclassified report" were allowed to remain even though used thousands of times.

In the thesaurus resulting from the second contract, a two-column arrangement is used, though the hierarchy indentations have been retained; this has reduced the sheer bulk of the thesaurus by some 60 percent of the approximately 70,000 descriptors in the dictionary, it is estimated that about 42,000 denote specific chemical compounds.

The classified thesaurus is issued in three parts. Part I (Confidential) contains the term and code, followed by chemical compound code numbers related to descriptor number, ointments and natural product number, Fort Detrick numbers, British TL's, etc. Part II (Secret) contains chemical compound nomenclature and cross-references to descriptor number, in a two-column format. Part III (Secret) contains the hierarchy by fields and groups. Indentations indicate the level of the hierarchy.

The thesaurus is used by indexers, Library and Information Retrieval Office staff members, in indexing and formulating search questions. This thesaurus is also used by Dugway Proving Ground under

an agreement reached by EA and Dugway when JITCO had contracts with both agencies.

3. DESCRIPTION OF PROCESSES

The original feasibility study of coordinate indexing for CWL conducted by Documentation, Inc., was followed in 1962 by the letting of a contract in 1962 for which JITCO was the successful bidder. As a result of this 18-month contract, a thesaurus was printed on EAM equipment, and 25,000 documents (20,500 index notes and 4,500 actual documents) were indexed and punched on cards. The second contract for 13 months resulted in a revised thesaurus printed by the IBM 1401 and the indexing and card-punching of an additional 8,700 documents (5,700 documents, 3,000 index notes). In addition, under the second contract, indexing data were stored on magnetic tape on the IBM 1401, and three sets of 10 test questions each were put to the file. Three punched card decks were generated: subject to accession number, accession number to call number, and descriptor number to descriptor.

All local Chemical Research and Development Laboratory (CRDL) publications were sent for indexing without regard to date of publication. All internally generated EA research and development reports were also included, regardless of year of publication. Additional entries from 1959 on were selected to complete the 25,000 number. Under

the second contract, all CRDL reports not included previously that were current were filled in, and then new ones were reviewed and selected as received.

(1) Input Procedures--Technical Library

1. New documents are received and checked for duplication.

2. Selection is made as to whether item goes immediately to contractor for indexing. (Since there is now a time lag between contracts, no documents are going at the present time.)

3. Items not going to the contractor are forwarded to Library indexers.

4. Indexers prepare index notes, including information exactly as it will appear on the catalog cards. The report call number, source, title, author, date, contract and project numbers, and subject index terms are included. Subject index terms are selected from the thesaurus prepared by the contractor and usually average 22 to 30 per document.

5. Index notes are forwarded to the typists for preparation of catalog cards. Unclassified items are typed on the IBM magnetic tape Selectric writer which stores the typed data on magnetic tape. The machine then automatically types additional catalog cards, adding an index entry in turn to the top of each card. The machine is also used to produce a multilith mat for use in producing the accessions list. Classified items are typed on regular typewriter, and entries are listed for the accessions list.

6. Catalog cards are filed under each of the added entries.

(2) Input Procedures--John I. Thompson

(For flow diagram of JITCO input procedures, see Figure 2).

1. Document is received from EA.

2. Security receipts are reviewed, the document identification is checked, document is logged in, and a check is made of the master record file to see if the document has already been indexed into the EA system.

3. A six-digit accession number is assigned.

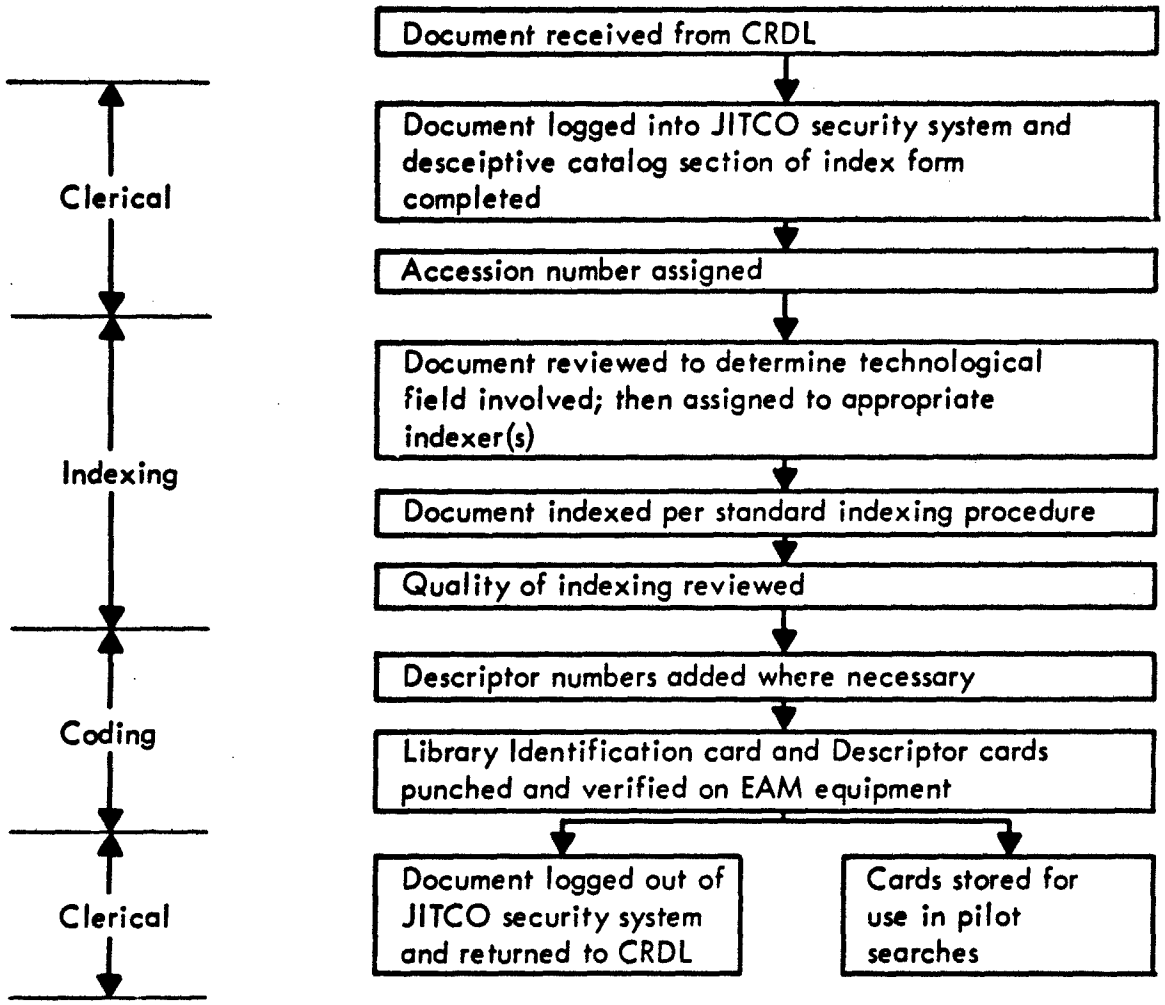

FIGURE 2
John I. Thompson Document Indexing and Coding Procedure

4. Descriptive cataloging from the title page of document cover is added to the code sheet (Index Record Sheet--see Figure 3). This information includes security classification, base report number and additional identification numbers, title, authors, and corporate author or originating activity.

5. Document and two copies of the code sheet go to the indexer. The indexer will be a subject specialist in one of the following four areas: (1) biology, microbiology, (2) chemistry, (3) biochemistry, and (4) engineering and mathematics.

6. Index terms and links are added as required.

7. Code sheet is attached to document and filed.

8. Indexing is received and corrected.

9. Code sheet and document are forwarded to the coders.

10. Coder annotates the code sheet, adding descriptor numbers assigned to descriptors used by indexers. These are derived from the EA dictionary.

11. Code sheet is forwarded to the keypunch operator.

INDEX RECORD SHEET

Accession No. _____ U C S CRD SRD OUO

CRDL-DPG Library No. _____

Other Identification No. _____ ASTIA No. _____

Title _____

_____

_____

Author _____

Originating Activity _____

		date			

Index-Coded _____

Reviewed _____

Punched _____ Verified _____

Job No. _____

FIGURE 3
Index Record Sheet

(3) Literature Search Processes

As part of the second contract, JITCO ran three pilot test searches of 10 questions each. In addition, since the tapes have been converted by NIII and AMS for use on the Honeywell 200/400 at EA, additional experiments are being run by EA.

1. Input Procedures

When a search is desired, the Document Search Request form (see Appendix B-1) is completed by the Library or Information Retrieval Office staff. This form includes the question number, the date, and requester's name on the first line, followed by each search request on a separate line including the question number, search number, date, type of question, number of descriptors in search, and coded descriptor number(s). Forms are forwarded to the Data Processing Section for keypunching and processing on the computer.

2. Outputs

Search results (see Appendix B-2) show question number, requester's name, and date, followed by the search

number and accession number, question type, request number, descriptor number, and call number of the referenced report. The user may obtain the desired items from the Library by use of the pertinent call numbers.

Searches were run on the Honeywell 200/400 to provide additional support for a special bibliography on V-agents and its supplement.

4. MAJOR PROBLEMS

The principal problem has been the lack of available systems design and programming talent and the part-time assignment of knowledgeable personnel to the project.

The high cost of operating this system, its lack of alphanumeric capability, and its low speed--complicated by the problem of scheduling computer time--have thus far frustrated the hopes of the designers to be able to provide half-day response to user questions.

5. ACTIVITIES BEING PLANNED OR DEVELOPED FOR MECHANIZATION

Future plans for mechanization at the EA Technical Library involve serials, refinements in the information retrieval program, and an SDI program.

Serials record processing is now under study. Negotiations have been underway for a year for a systems person to study a fully automated system. Plans call for the generation of a subject-classed list claims letters, first-copy lists, binding lists, serials expiration lists, cumulative holdings lists, and monthly accessions lists. It is hoped that 700 man-hours per year could be saved under the planned system, which is to be designed for compatibility with Redstone Arsenal and Fort Detrick.

Changes in the information retrieval system, now in the operational testing stage, would involve the addition of an alphabetic print-out capability to the existing system. This would include authors, titles, and other bibliographic data. Fifty percent of the requests received at EA are considered subject searches, not all of which are computer type. The other 50 percent involve author, source, contract, etc. A proposed action plan is being submitted for the addition of the above changes to the information retrieval system.

An SDI program based on the Medical Literature Analysis and Retrieval System (MEDLARS) tapes is being considered. Profiles would most likely be based on branches and laboratories rather than individuals.

A possibility being considered is that of obtaining bibliographic data on EA reports at the time of publication by the Reports Publication Section (Technical Releases Branch), for later use in the system. For the past three years, abstracts have been issued for internal reports, and the Technical Releases Branch is publishing a notice of forthcoming publications through an Advanced Abstracts Program. In addition, the University of Pittsburgh has a contract to abstract items which did not include abstracts when selected for inclusion in the retrieval program, and to abstract many new EA reports. Form 1473's (Document Control Data--R&D) are being prepared under this contract. In each of these cases, there is a possible area for mechanization.

A refinement of the Information Retrieval Office's Technical Effort Locator program might involve mechanization. Some systems work toward a mechanized base has already been done by EA. In the earlier program, 12 Chemical Corps Elements contributed data on their current projects. These data were collected and added to punched cards to be searched manually, since time was not available on the Univac computer in use at EA at the time and the size of the sample did not necessitate computer manipulation. The program was feasible and desirable on a broad organizational basis, but its utility for EA's community alone was questionable. Moreover, techniques to handle a free vocabulary were not available. In such a future program, a disciplined vocabulary would

be necessary. The DD Form 1498, Research and Technology Resume, may well replace or update the EA Techinical Effort Locator Program.

Graphic arts material is being considered for eventual inclusion in an overall retrieval system.

III PROGRAM SYSTEM DATA

1. FILES

(1) Master File

This is an iverted file containing descriptor numbers, accession number, and links. Accession numbers are six digits long, and links take the form of two-digit appendices to each accession number . Two hundred and fifty such items are blocked into records. The Master File was created and is updated periodically by JITCO. It is converted from IBM format to Honeywell format by contract with NIH and AMS. At present there are 560,000 items distributed on four reels of tape to speed searching. For other purposes, this file is maintained on a single reel of tape.

(2) Library Number File

This file is a cross-reference file of accession numbers and Library numbers for documents. Security classification is also included but is unused at the present time. Each item is 80 characters long or ten words, and five items are blocked in each record.

2. PROGRAMS

(1A) Card to Tape

Retrieval questions on cards are converted to tape on the H-200 computer. Each question is numbered and is made up of combinations of descriptor numbers and Boolean connectors.

(1B) Edit and Reformat

A unique item is created from each descriptor entered.

(2) Descriptor Sort

All descriptor numbers are sorted into numeric sequence by the Honeywell 400.

(3) Screen

Descriptor numbers are compared to the Master File, and a work tape is produced containing accession numbers of all possible document matches.

Two techniques are employed in this program to reduce execution time. The highest descriptor number in each of the four tapes is recorded. Searching is discontinued on one tape and is begun on the second when the occasion warrants, without

reading through the entire file. In addition, with blocked records, the last item of a block is checked against the search description for range before searching each item in the block.

(4) Work Tape Sort

The work tape is sorted by search numbers to reconstruct the original questions.

(5) Evaluate

The search statement is evaluated by evaluating the truth of the individual terms that have been accepted by the Screen program in the light of their Boolean relationships. The operators "and" and "but not" and "or" may be used to link any number of terms. At the present time no involved complex relationships are possible, but the program is being modified to allow their use.

(6) Work Tape Sort

The selected entries are sorted into accession number sequence.

(7) Select Library Number

Library numbers corresponding to accession numbers retrieved are selected from the Library Number file.

(8) Sort

The selections are sorted into question number sequence.

(9) Edit and Print

Output selections are edited into final format and printed.

IV. EQUIPMENT, COSTS, AND EVALUATION

1. EQUIPMENT

The Government-owned Honeywell 200/400 system was transferred from another Army agency to EA in July 1964. It is operated by the Data Systems Office and is used primarily for business-type problems such as payroll, property management, and quality assurance. It is run slightly over two shifts per day. The programs for the system are written in COBOL language.

Software--H200

Easy coder assembler
card-tape, tape-card, and tape-print utility packages

Honeywell 400

8 tape units including 2 switchable to 200

Honeywell 200

card reader/punch
IBM magnetic tape Selectric writer (rented for $250 per month)

2. COSTS AND TIME

Data Systems Division designed, programmed, and debugged the original programs with the assistance of the Honeywell representative. Total labor figures are not available. The effort took place over a four-month period. The programs were modified slightly once and are currently being modified again to gain speed and flexibility.

The Library staff averaged three to four days per month in working with contract and retrieval programs over a 33-month period. This includes both the alternate project officer's time and that of the clerical staff.

Two retrievals performed recently on the system, each involving 60 to 80 questions, ran for 9 and 11 hours. Modifications to the system now being planned are expected to reduce run time by about 40 percent. However, only 15 percent of the total document collection is presently in the file.

3. FACILITY'S EVALUATION OF SYSTEM

In addition, the Librarian, Lawrence S. Papier, has made several studies on system evaluation, though these are not directly related to the system at EA. These studies have involved techniques and criteria for evaluation (users, cost, and the like).

B I B L I O G R A P H Y

Evaluation of Science Communications Systems, by Lawrence S. Papier, CRDL No. 4-65, AD 615 108, February 1965, published by the Technical Information Division, U. S. Army Edgewood Arsenal Chemical Research and Development Laboratories, Edgewood Arsenal, Maryland.

APPENDIX A

ORGANIZATION CHARTS

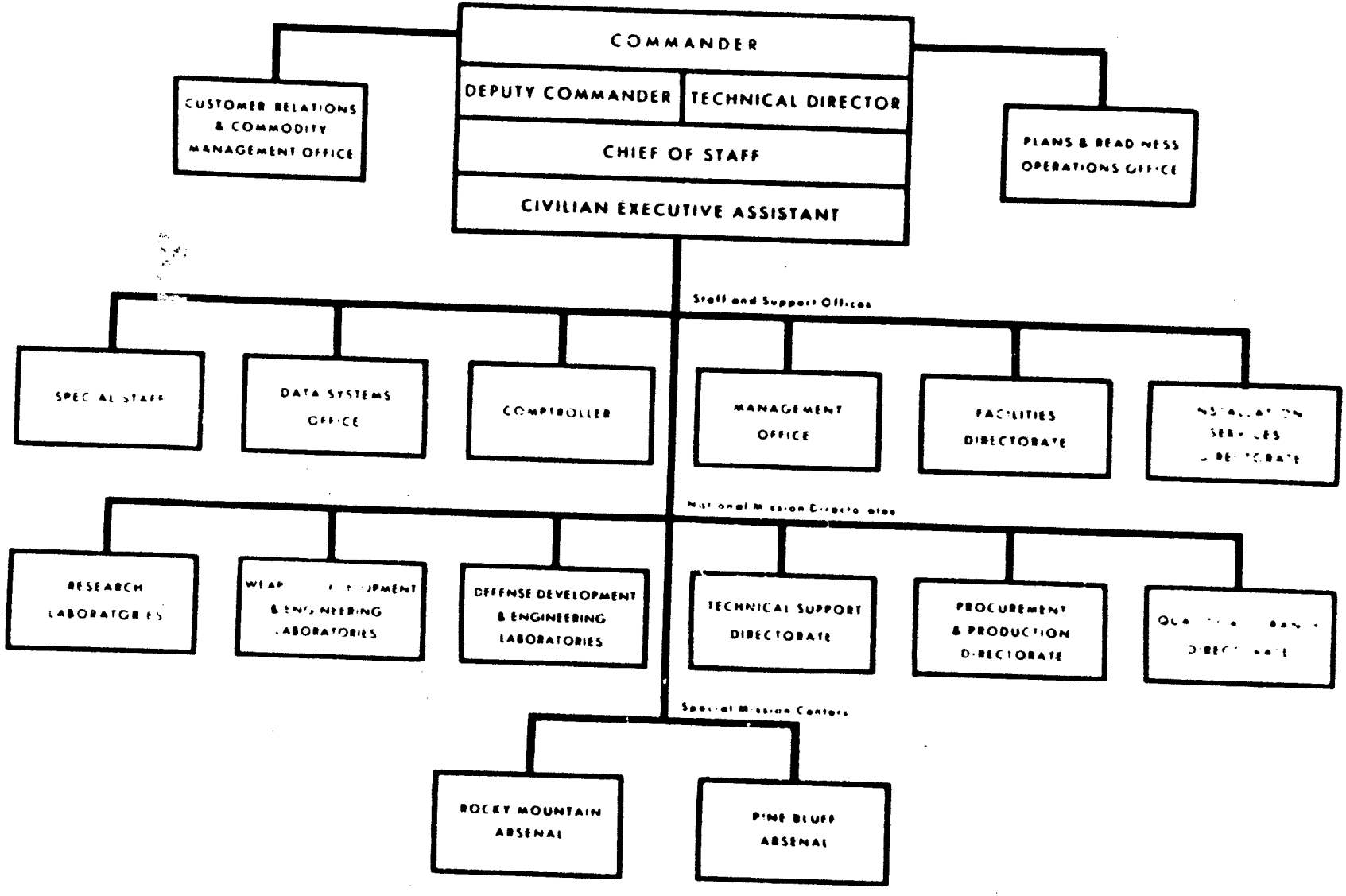

FIGURE A-1
U.S. Army Edgewood Arsenal

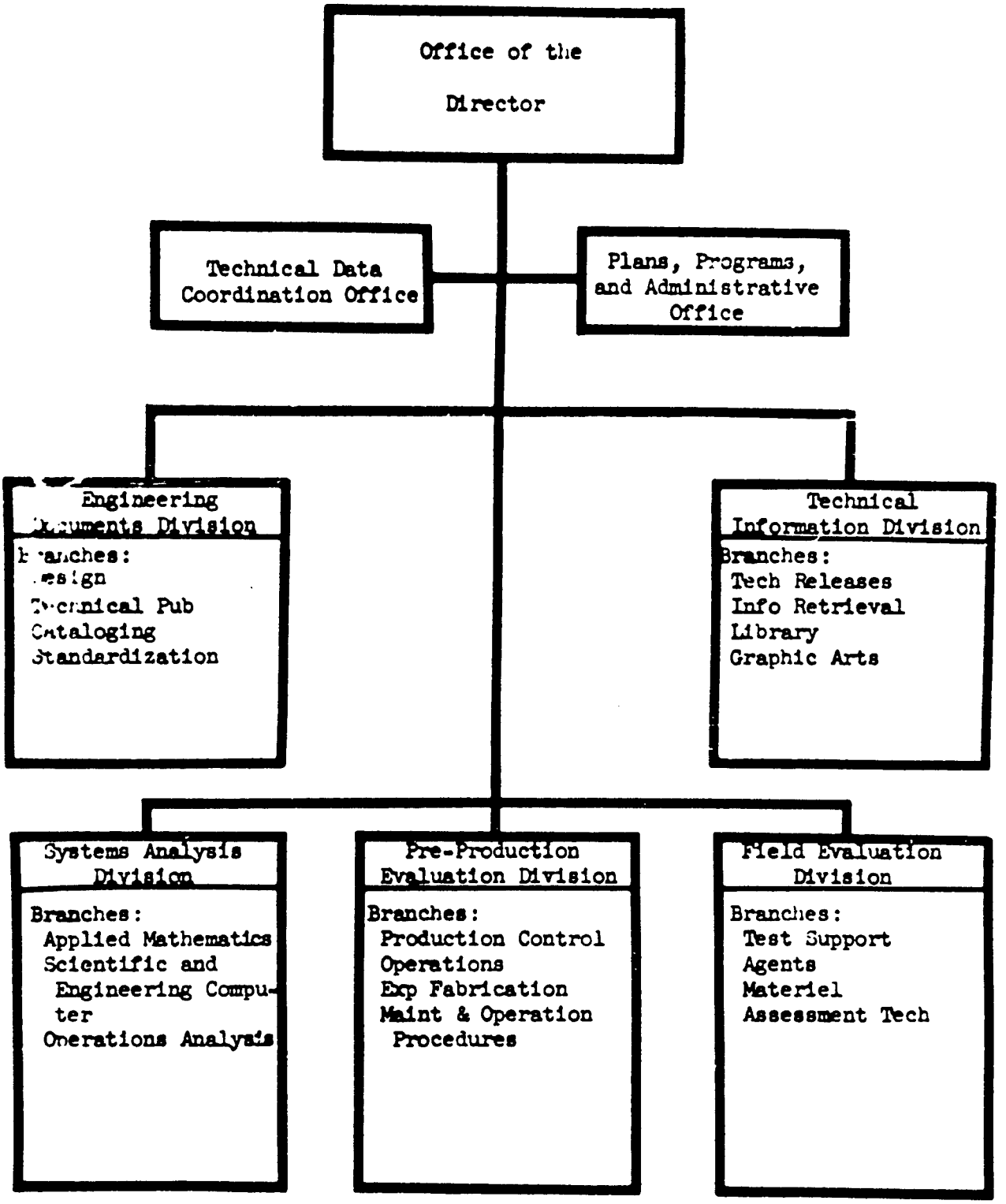

FIGURE A-2
Technical Support Directorate

APPENDIX B

LITERATURE SEARCH PROCESSING

QUESTION NO.	DATE	INQUIRER'S NAME	
04	110665	Kracke, Robert D.	*
(3-6)	(9-14)	(17-32)	(70)

QUESTION NO.	SEARCH NO.	DATE	TYPE QUESTION	NO. OF DESCRIPTORS IN SEARCH	DESCRIPTOR NO.	DESCRIPTOR NO	DESCRIPTOR NO.	DESCRIPTOR NO.	DESCRIPTOR NO.	
04	01	110665	2	02	066817	077324				1
(3-6)	(7-8)	(9-14)	(17)	(18-19)	(27-32)	(33-40)	(41-48)	(51-56)	(59-64)	(70)

QUESTION NO.	SEARCH NO.	DATE	TYPE QUESTION	NO. OF DESCRIPTORS IN SEARCH	DESCRIPTOR NO	DESCRIPTOR NO.	DESCRIPTOR NO	DESCRIPTOR NO.	DESCRIPTOR NO	
04	02	110665	2	02	066817	036097				1
(3-6)	(7-8)	(9-14)	(17)	(18-19)	(27-32)	(33-40)	(41-48)	(51-56)	(59-64)	(70)

QUESTION NO.	SEARCH NO	DATE	TYPE QUESTION	NO. OF DESCRIPTORS IN SEARCH	DESCRIPTOR NO.	DESCRIPTOR NO.	DESCRIPTOR NO.	DESCRIPTOR NO.	DESCRIPTOR NO.	
04	03	110665	2	02	066817	000270				1
(3-6)	(7-8)	(9-14)	(17)	(18-19)	(27-32)	(33-40)	(41-48)	(51-56)	(59-64)	(70)

COL. 17 1 'DOT NOT' (PRECEDE EXCLUDED DESCRIPTOR NO. WITH *)

2 OTHER THAN 'DOT NOT

NOTE: ALL COORDINATES OF AN 'AND' PHRASE MUST RECEIVE THE SAME SEARCH NUMBER.

SMUEA FORM 16 (VISF)

15 OCT 66

FIGURE B-1
Document Search Request (STINFO)

QUES NO	NAME	DATE
04	KRACK ROBERT D	110665

SRCH NO	ACCES NO	QUS TPE	REQ NO DEC	DESCR NO
01	00000613	2	02	66817 CCWL 550-116/PART 2 BW-CW APPLICATIONS 77324
01	00000616	2	02	66817 ~~CCWL 550-116/PART 2 BW-CW APPLICATIONS~~ 77324
	00000617	2	02	66817 ~~CCWL 550-116/PART 2 BW-CW APPLICATIONS~~ 77324
	00016902	2	02	66817 CAPG-DPS REPORT 166 77324
	000.6904	2	02	66817 ~~CAPG-DPS REPORT 166~~ 77324
	00016905	2	02	66817 ~~CAPG-DPS REPORT 166~~ 77324
	00017103	2	02	66817 CAPG DPS REPT. DPS 467 77324
	00017203	2	02	66817 CAPG DPS/OTA-26 77324
	00032803	2	02	66817 CDPGTR 280 77324
	00057004	2	02	66817 CPORTON NOTE 140 77324
	00057301	2	02	66817 CPORTON NOTE 163

FIGURE B-2
Sample of Literature Search Results

Unclassified
Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)
BOOZ ALLEN APPLIED RESEARCH, INC.
4733 Bethesda Avenue
Bethesda, Maryland 20014

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b. GROUP

3. REPORT TITLE
Mechanization Study of the Technical Library, U. S. Army Edgewood Arsenal, Edgewood, Maryland

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Final Report of on-site survey

5. AUTHOR(S) (Last name, first name, initial)
G. A. Kershaw, D. Crowder, J. E. Davis, E. G. Loges, E. Merendini, S. M. Thomas

6. REPORT DATE
September, 1966

7a. TOTAL NO. OF PAGES
39

7b. NO. OF REFS
1

8a. CONTRACT OR GRANT NO.
DSA-7-15489

b. PROJECT NO.

9a. ORIGINATOR'S REPORT NUMBER(S)
914-1-28

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
AD 640 123

10. AVAILABILITY/LIMITATION NOTICES
Distribution of this Document is unlimited

11. SUPPLEMENTARY NOTES
None

12. SPONSORING MILITARY ACTIVITY
Defense Supply Agency
Defense Documentation Center
Cameron Station, Virginia

13. ABSTRACT

The Edgewood Arsenal Technical Library uses a retrieval system designed and developed for the Library by a contractor. The contractor indexes and processes documents on punched cards, and tapes generated on the Contractor's IBM 1401 are converted to Honeywell 200/400 tapes for use on EA's Honeywell computer by National Institutes of Health and Army Map Service. Search outputs enable the user to obtain desired items from the Library by use of the pertinent call numbers. The addition of an alphabetic printout capability of the existing system is now in the operational testing stage. The hopes of the designers of the system to provide half-day response to user questions have thus far been frustrated by several factors, including the high cost of operating the system and its low speed.

DD FORM 1473

Unclassified
Security Classification

Security Classification

14 KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
Digital Computers Information Retrieval						

INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization (corporate author) issuing the report.

2a. REPORT SECURITY CLASSIFICATION: Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. GROUP: Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been assigned to Group 1 as author[illegible].

3. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. REPORT DATE: Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

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